Using the Delphi method to verify a framework to implement sustainability initiatives

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Abstract

The paper provides a Delphi study to verify the framework to implement sustainability initiatives in the business processes. The Delphi technique seeks to obtain consensus on the opinions of experts, termed panel members, through a series of questionnaires. As part of the process, the responses from each round are fed back in summarized form to the participants who are then given an opportunity to respond again to the emerging data. The study successfully obtained a consensus in the phases and steps of the conceptual framework and provided feedback from the specialists. According to them, leadership, people and cost were identified as the main challenges related to the sustainability adoption by the organisations and key performance indicators (KPIs), Lifecycle assessment (LCA) and triple bottom line (TBL) were identified as the main methods to assess al the sustainability dimensions in terms of business processes.

Keywords

Business Process Management; Sustainability, Sustainability adoption; Delphi study;

1. Introduction

Previous studies have developed a framework to implement sustainability initiatives (Gallotta et al 2016 and Gallotta et al 2017). The framework aims to support the business transformation by applying Business Process Management (BPM) techniques to the implementation of sustainability initiatives. The framework thus considers the implementation of sustainability as a multi-departmental and multi-functional activity with an end-to-end process view and contains four (4) phases: Analyse, Design, Implement and Monitor & Control (Gallotta et al 2016). Figure 1 represents the framework.

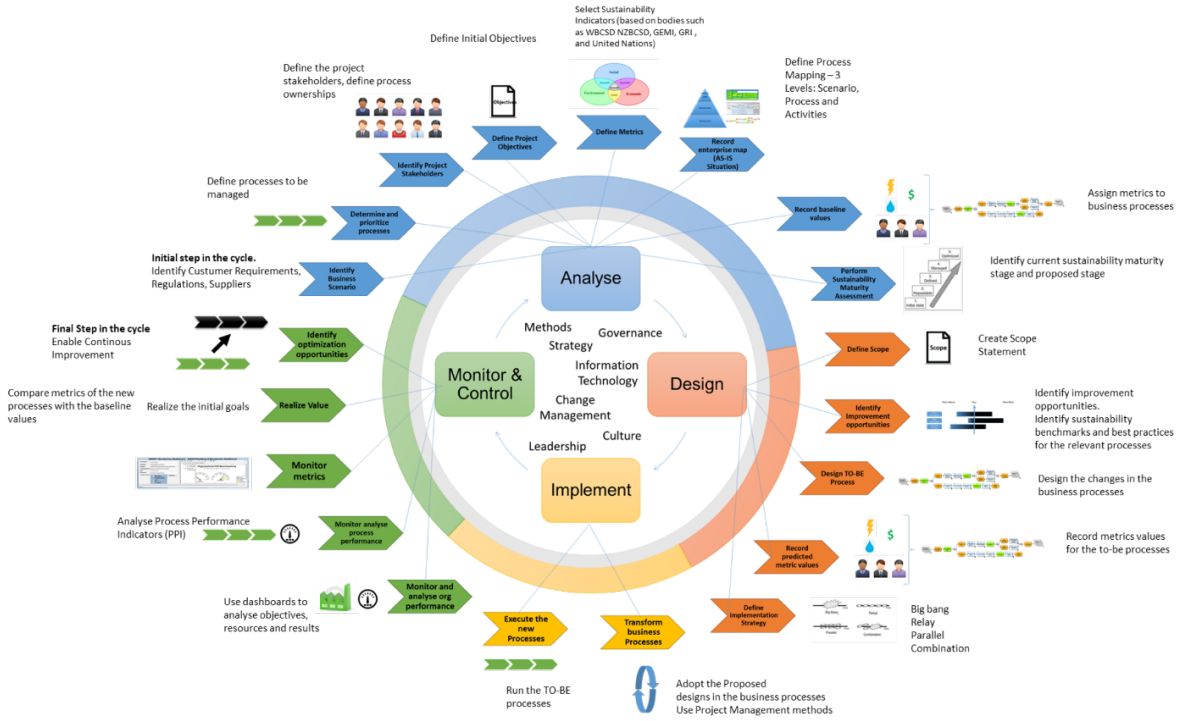

Figure 1 Framework to implement sustainability initiatives in the business processes. Source: Gallotta el al. (2016)

A Delphi study was carried out in order to verify this framework. The study was performed between June 2016 and August 2016 and contained 21 specialists (from both academia and industry) from six different countries. This paper deals with the Delphi method surveying a panel of experts in sustainability and operations management, providing them with controlled feedback and repolling them in order to obtain the consensus in the design of the conceptual framework.

1.1. Delphi Method

The Delphi method relies on the use of expert opinions "to obtain the most reliable consensus" via a series of questionnaires with controlled feedback within a Pannel (Dalkey and Helmer, 1963 and Hasson et al 2000), The purpose of this technique is either forecasting/issue identification or concept/framework development (Okoli and Pawlowski, 2004 and Schmiedel et al 2013). According to Linstone et al (2002), the Delphi method may be viewed as one of the spinoffs of defence research. "Project Delphi" was the name given to an Air Force-sponsored Rand Corporation study, starting in the early 1950's, concerning the use of expert opinion. The objective of the original study was to "obtain the most reliable consensus of opinion of a group of experts ... by a series of intensive questionnaires interspersed with controlled opinion feedback.". The intent of the Delphi, as it was originally conceived, was to create a method, using expert opinions, to forecast long-range trends related to the military potential of future science and technology and their effects on political issues (Gordon, 1994; Linstone & Turoff, 1975). The method became high popular from the mid 90s (Habibi et al 2014) and according to McKenna (1994), it has been used in over 1,000 published research projects.

According to Krigsholm, et al (2017) there are several variants of the method, but all Delphi studies have some key elements in common. First, a Delphi study consists of multiple rounds of formal questionnaires, and the respondents are anonymous to one another. Second, a Delphi study builds upon iterative, controlled feedback. That is, after each round experts can revisit and rethink their answers in the light of the information provided. Third, a Delphi study presents a statistical summary of the group's responses. The process continues until a set level of stability in answers is reached (Filyushkina, et al 2018). In essence, the Delphi technique has been described as a qualitative data analysis and consensus method providing a means of obtaining the insights of appropriate experts to enable decisions to be made (Strang 2017, McGeary, 2009; Strang, 2015).

1.2. Likert scale

According to Wadagave et al (2016), Likert scale is a psychometric response scale primarily used in questionnaires to assess subject's perception. Most commonly seen as a 5-point scale (Ordinal data), each level on the scale is assigned a numeric value (Jamieson, 2004).
For the maters of this study, it was used the following definition:

1 = strongly disagree
2 = somewhat disagree
3 = neither disagree or agree
4 = somewhat agree
5 = strongly agree

Therefore, the average response value is defined by the following formula:

$$Average = \frac{\sum_0^n response\ index}{n}$$

In order to convert this average into percentage, it was used the following formula:

$$Percentage = \frac{Average}{5}$$

*5 because it is the maximum numeric value of the scale. If it was defined a 7-point scale, the denominator would be equals to n x 7.

1.3. Consensus definition

Since the main objective of the Delphi study is to obtain consensus, it is important to firstly define the concept of consensus. A consensus is in essence, a general agreement, an unanimity, the majority of opinion of a determined group. Robert and Schermers, et al (2011) consider different types of majority, such as greater than one half (more than 50%), three fifths (60%), two thirds (66%) and three quarters (75%). Therefore, any question with a score of acceptance higher than 75% was considered as a consensus.

2. Methodology

The first part of the study was to define the problem, and define the questionnaire to be sent to the specialists. The second step was the selection of the experts in the field of sustainability and operations management. The third step was the round one of the study and the fourth and last step was the second round of the study. At the end of the study, the results were sent to the participants. Figure 2 represents the methodology for the study.

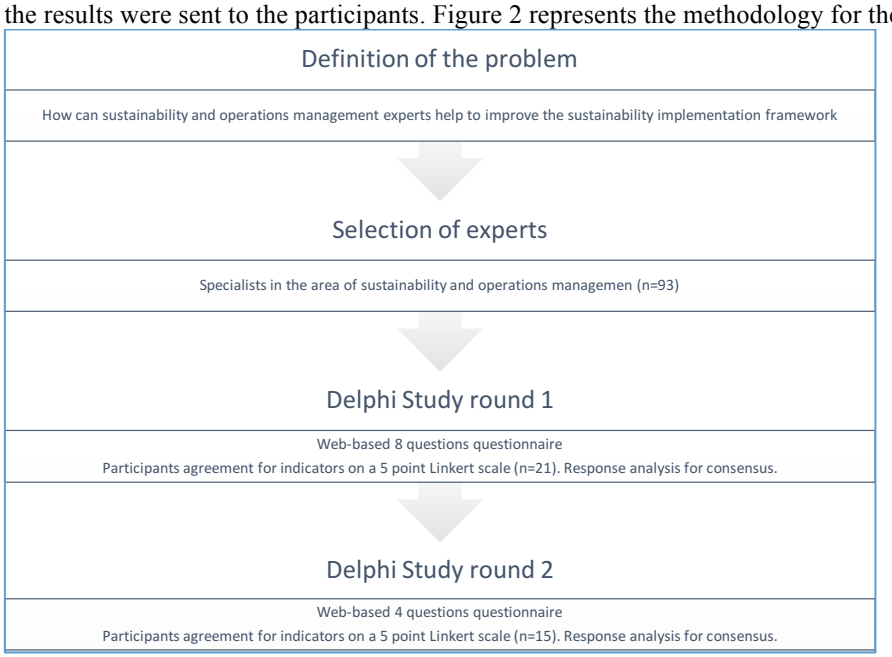

Figure 2 Methodology

3. The Delphi study

3.1. Participants

The participants for this study were found on Linkedin, Research gate, conference publications, and universities websites. In order to be considered a specialist, the person should occupy 1) Industry: Experience with leadership positions (such as Manager, Director, position) with more than 3 years of experience in Sustainability and operations management or 2) Academia: Involvement with sustainability and operations management for at least 3 years and publications of the topic. After this, 93 people were identified as potential participants for the study.

From the total of 93 people contacted, 21 responded the e-mail and agreed to take part in the study, representing a total of 29.16% response rate.

Among the participants, there were people from different job positions, such as Researchers, Lecturers, Professors, Managers, Directors and CEOs from different organisations from several countries.

In total, there were 14 researchers from the academia and 7 from the industry. The participants were based on 6 different countries (Brazil, Germany, UK, Mexico, Sweden and Netherlands), Figure 3 represents the distribution of specialists per country. The specialists comprised 9 different job positions (Green developer, management partner, researcher, lecturer, senior lecturer, professor, manager, sustainability vp and sustainability consultant), Figure 4 represents the distribution of experts per position.

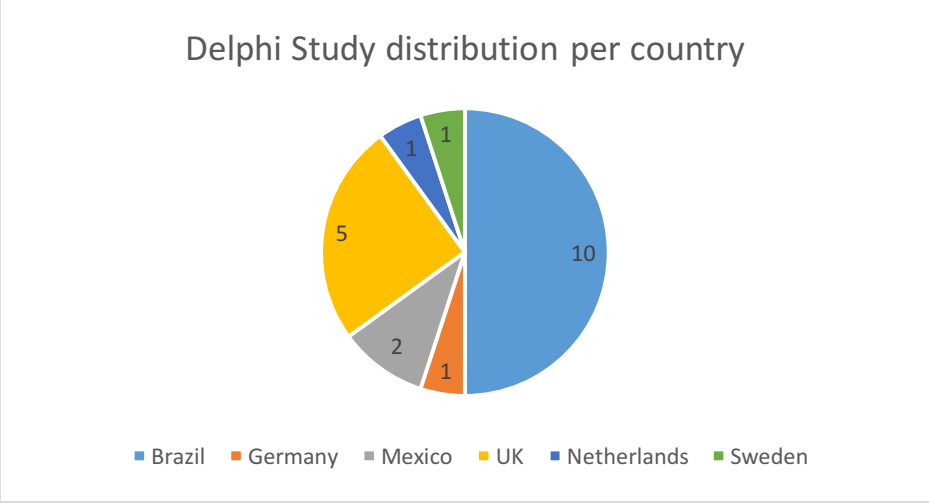

Figure 3 Delphi Study distribution per country

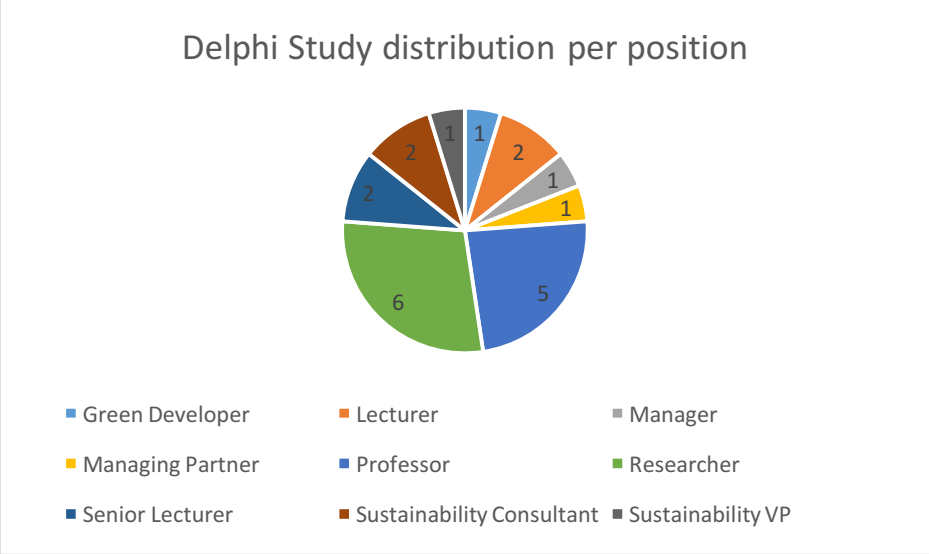

Figure 4 Delphi study distribution per position

3.1. Test round

Before submitting the questionnaire to the participants, it was conducted a test round as form of a pilot with 10 English native speaking participants. These participants didn't have any education or work experience with sustainability and or operations management. The non-biased participants were chosen so the questionnaire was clear, coherent and didn't have any grammar errors. The pilot test started on the 17th of June 2016 and lasted until the 23rd of June 2016.

3.2. Delphi Study first round

After concluding the test round, the outputs from the participants were evaluated and considered to the questionnaire to be sent to the specialists.

The initial challenge to create the questionnaire relies on how to define the appropriate questions in order to obtain the most accurate and valuable results from the respondents. The questions need to be concise, direct and should have a logical connection. It should englobe all the required information, but in the interim, it shouldn't consume a lot of time from the respondents.

In a general view, it was identified 8 groups of questions. 1) Sustainability, 2) Process Improvement, 3) Process Improvement & Sustainability, 4) Analyse phase, 5) Design phase, 6) Implement phase, 7) Monitor & control phase, and 8) Enablers of the implementation.

Table 1 Group of questions - round 1

1) Sustainability 2) Process Improvement 3) Process Improvement & Sustainability		
4) Analyse	Identify Business Scenario Determine and prioritize processes Define stakeholders Define project objectives Define Metrics Record enterprise map Record baseline values Perform Sustainability maturity assessment	
5) Design	Define Scope Identify Improvement Opportunities Design to-be process Record predicted metrics values Define Implementation Strategy	
6) Implement	Transform Business Processes Execute new processes	
7) Monitor & Control	Monitor and analyse organisational performance Monitor and analyse process performance Monitor Metrics Realise value Identify optimisation opportunities	
8) Process Improvement	Relate with	Governance Strategy Methods Information Technology

		Change Management Leadership Culture

3.3. Delphi Study second round

The first round has obtained the consensus in all the steps on the framework, however some information was still lacking. Therefore, for the second round it was defined 4 groups of questions:

Table 2 Group of questions - round 2

Challenges to implement sustainability initiatives in organisations
How it is possible to assess the sustainability dimensions in terms of Business Processes
If they would change the order of the steps of the framework
How they would improve the framework

4. Results and Discussion

In the first round of the study, the lowest acceptance rates were found in the items '**Record enterprise map**' (75.24%), '**Is Sustainability Implementation directly linked to Process Management?**' (76.19%), '**Design to-be process**' (81.67%). Whilst the highest acceptance rates were found in the items '**is it justified to use the Business Process Management (BPM) approach**' (95.24%), '**Monitor and analyse process performance**' (95.24%) and '**Monitor metrics**' (91.67%). The steps of the framework have received the following rates: Analyse (82.38%), Design (85%), Implement (87.14%), and Monitor and Control (89.71%). Regarding the framework enablers, Business Strategy had the highest acceptance rate (90.5%), whilst Methods and Information Technology received only 28.6%. Figure 5 and Table 3 summarize the results of the first phase of the study.

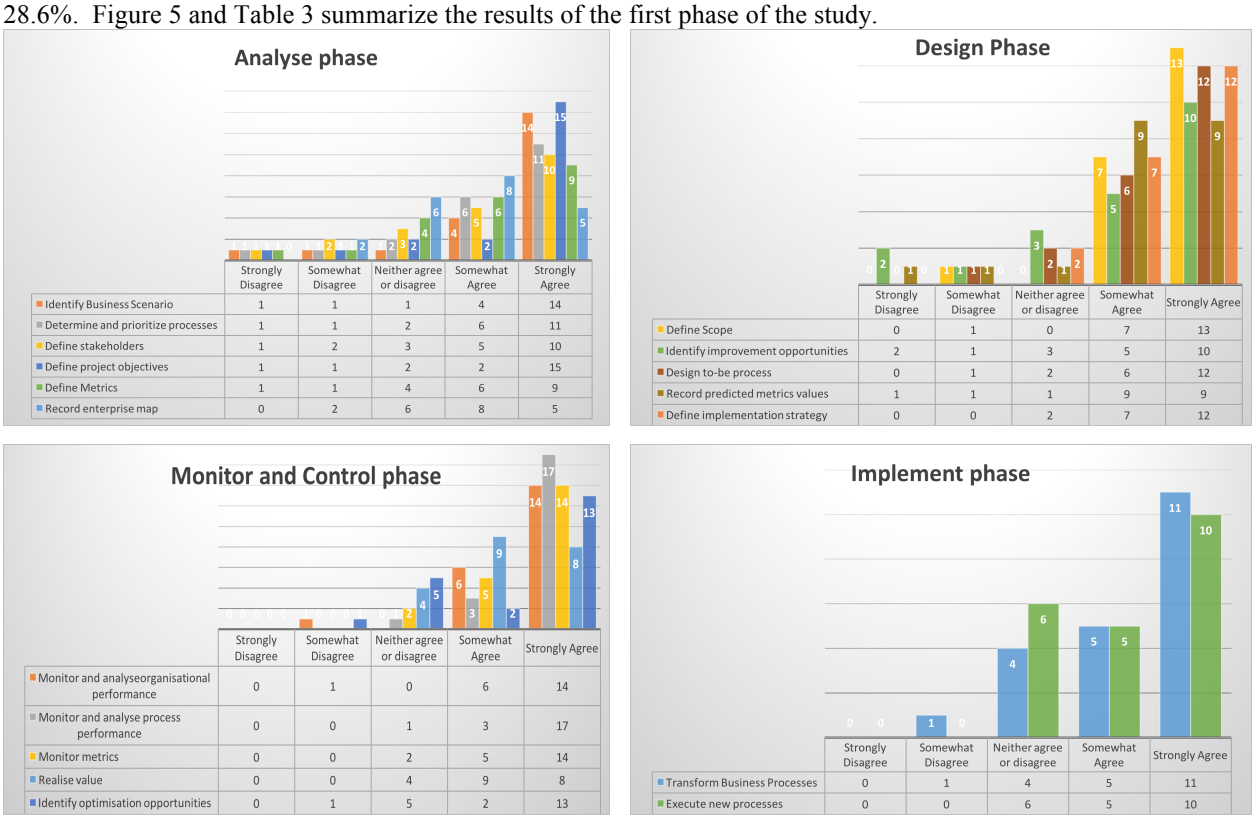

Figure 5 Summary of the responses

Table 3 - Summary of the responses

	76.19%

Is Sustainability implementation directly linked to Process Management?			
is it justified to use the Business Process Management (BPM) approach?		95.24%	
Is it justified to represent the implementation of Sustainability initiatives using the BPM tool as the framework suggests?		85.71%	
Analyse phase	Identify Business Scenario	87.62%	**82.38%**
	Determine and prioritize processes	83.81%	
	Define stakeholders	80.00%	
	Define project objectives	87.62%	
	Define metrics	80.00%	
	Record enterprise map	75.24%	
Design phase	Define scope	80.00%	**85%**
	Identify improvement opportunities	84.76%	
	Design to-be process	90.48%	
	Record predicted metrics values	79.05%	
	Define Implementation strategy	87.62%	
Implement phase	Transform business processes	82.86%	**87.14%**
	Execute new processes	89.52%	
Monitor and control phase	Monitor and analyse organisational performance	91.43%	**89.71%**
	Monitor and analyse process performance	95.24%	
	Monitor metrics	91.43%	
	Realise value	83.81%	
	Identify optimisation opportunities	86.67%	

Therefore, it was concluded that there was a consensus in all of the questions, since all of them had been approved by over than 75%, as it was defined on the topic 1.3. Consensus Definition.
Regarding the enablers for the framework, there was a scattered opinion on its applicability. The conceptual framework proposed the following enablers: Organisational Culture, Leadership, Change Management, Information Technology, Business Strategy and Corporate Governance. Figure 6 represents the level of agreement of the enablers to implement sustainability initiatives

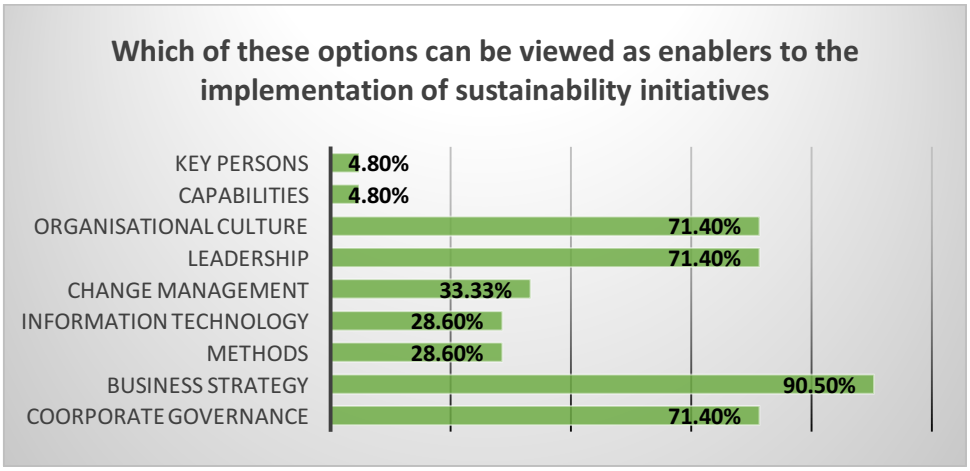

Figure 6 Enablers for the implementation of sustainability initiatives

For the second round of the study, it was used more generic questions intended to improve the practicality of the framework. The results had a more qualitative character.
Leadership, people and cost were identified as the main challenges related to the sustainability adoption by the organisations. According to one expert of the study, "the multiple factors a company needs to consider parallel with sustainability, such as other factors coming from global competition (ex profitability, conditions compared to low cost countries), meeting different customer demands, legislative and not, as well as just responding to other future trends such as digitalisation, flexibility, etc.". Another specialist related the sustainability implementation with the organisational culture, "in my opinion, the main challenge to implement sustainable practices in organization is related to organizational culture. In general, many companies see sustainability as additional cost or legal requirements. There are a lot of sustainable business practices but most companies have not yet adopted them". Figure 6 summarises the main challenges to adopt sustainability initiatives.

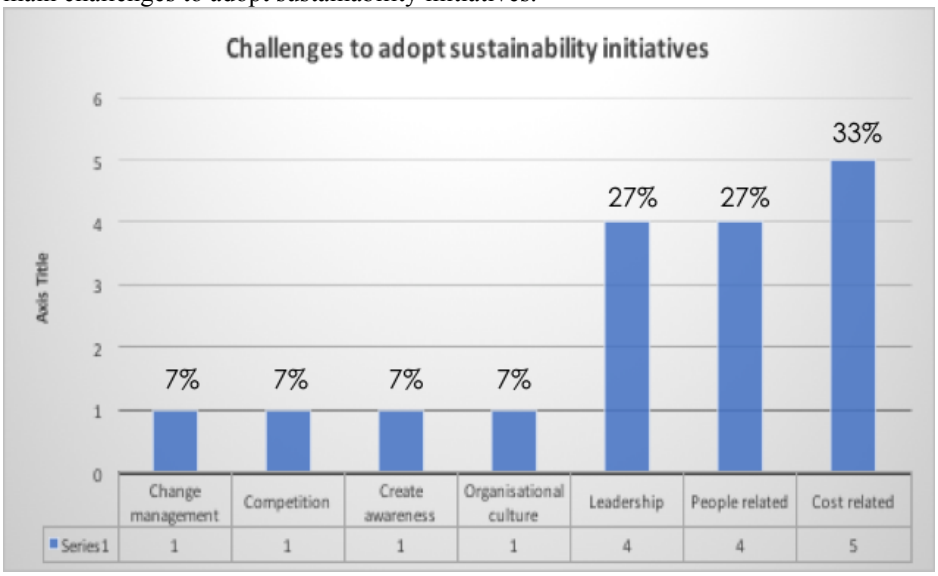

Figure 7 Summary of the challenges to adopt sustainability initiatives

The second question had a more heterogeneous character of responses. Key performance indicators (KPIs), Lifecycle assessment (LCA) and triple bottom line (TBL) were the most cited keywords, but only with 2 occurrences. According to one expert, "the main point is to link all these three dimensions form the triple bottom line. A holistic view of the triple bottom line is crucial to achieve and assess sustainability in terms of Business Processes. Unfortunately, it´s my perception that sustainability is something vague and mostly related to strategic level of organisations. So, one must create a bridge between strategy and operations to assess sustainability." and also related business processes with the sustainability dimensions. Another specialist stated that "In order to assess all the sustainability dimensions in terms of business processes it's important to identify how and what the business processes influence each dimension, which activities and aspects are relevant, and which are the hotspots for each dimension in order to allow companies to prioritize the activities and aspects with highest potential for improvement in terms of sustainability. Thus, companies could develop and implement performance indicators on business process, but it is still a challenge to solve trade-offs between the three dimensions". Figure 7 summarises the responses on how to assess sustainability dimensions.

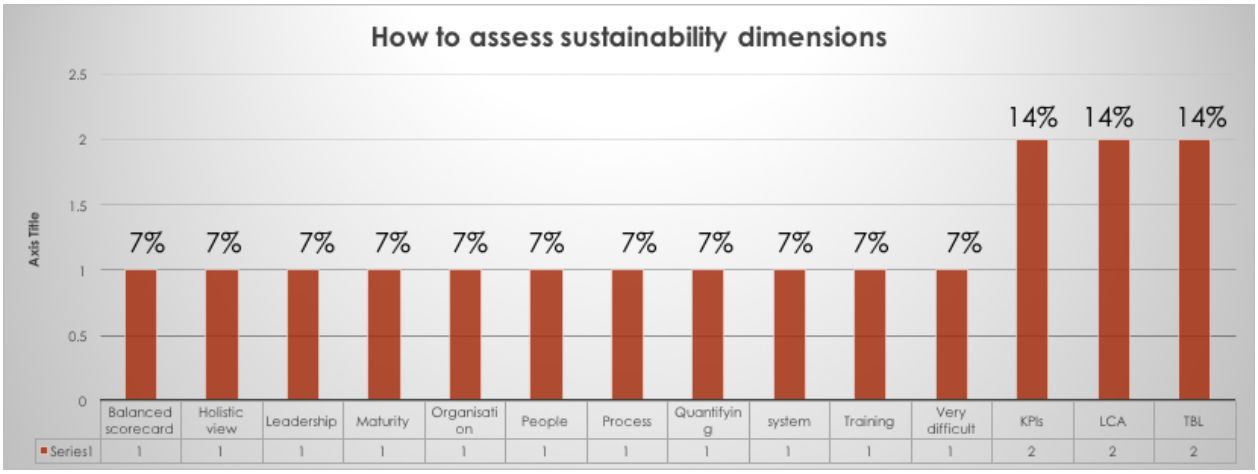

Figure 8 Summary of how to assess sustainability dimensions

Question 3 was intended to observe if the order of the steps on the framework were correct and logic. Most of the specialists agreed on the order (87%). Most of the specialists stated that the framework "was fine", but one stated that "Sustainability maturity should be part of monitor and control depending on individual situation". Another specialist made another observation, "It makes sense to have them in that order, but I am considering the factors in the middle to also influence a lot if this wheel will work. And also, what other dominant strategies and focuses the organisation have. Are they aligned?" which relates the framework with the proposed enablers. Figure 8 presents the results of the question.

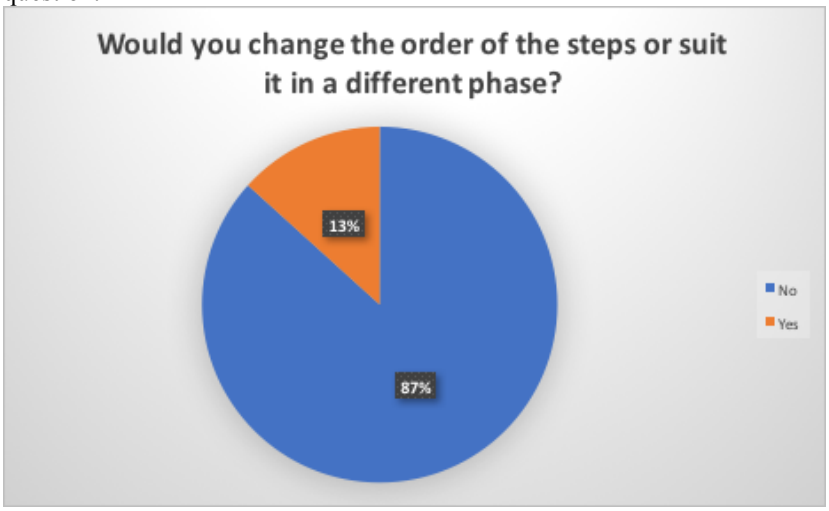

Figure 9 Would you change the order of the steps or suit it in a different phase

Question 4 was intended to obtain final comments regarding the framework. Most of the answers were "it looks fine", but some specialists mentioned other aspects, such as "appropriateness", "identification of key deliverables", "alignment to other objectives and goals", "metrics review" (which is already as the step "monitor metrics") and "the creation of an initial step to define the concept of sustainability".

After the verification of the framework by the specialists using the Delphi Study, the main change was regarding the enablers. The conceptual framework proposed the following enablers: Organisational Culture, Leadership, Change Management, Information Technology, Business Strategy and Corporate Governance. After the experts' feedback, the verified framework contained the enablers: Organisational Culture, Leadership, Business Strategy and Corporate Governance. Future work aims to validate the framework in a real-world scenario.

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6. Biography

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Bruno Gallotta is a PhD candidate in Sustainability and Business Processes at the University of Derby, Derby United Kingdom. He earned BSc in Science and Technology from Universidade Federal do ABC, Brazil, BSc in Management Engineering from Universidade Federal do ABC, Brazil, and Masters in Research from University of Derby, United Kingdom. He has published conference papers. Mr. Bruno has been a Business Consultant since 2010, with experience in Knowledge Management (KM), Process Design, Internet of Things (IoT), IT Corporate Sustainability and Business Process management (BPM). Participation in projects of different lines of business, such as Mining, Oil&Gas,

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Jose Arturo Garza-Reyes is a reader in Operations Management and Business Excellence at the Centre for Supply Chain Improvement, Derby Business School, the University of Derby, UK. He has published a number of articles in leading international journals and conferences, including *International Journal of Production Research*, *Production, Planning & Control, International Journal of Production Economics*, *Journal of Cleaner Production*, *Robotics and Computer Integrated Manufacturing*, *Journal of Manufacturing Technology Management*, *International Journal of Quality and Reliability Management*, *TQM & Business Excellence*, among others. Garza-Reyes has also written two books in the areas of quality management systems and manufacturing performance measurement systems. He has participated as a guest editor for special issues in the *Supply Chain Management: An International Journal*, *Production Planning & Control*, *International Journal of Lean Six Sigma*, *International Journal of Lean Enterprise Research*, *International Journal of Engineering Management and Economics*, and *International Journal of Engineering and Technology Innovation*. Jose Arturo is co-founder and current Editor of the *International Journal of Supply Chain and Operations Resilience* (Inderscience). He is currently serving in the editorial board of several international journals as well as a member of the scientific and organising committees of several international conferences. His research interests include general aspects of operations and manufacturing management, operations and quality improvement and performance measurement.

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